
XIV. *On the Origin and Nature of the Ligulate Rays in Zinnia ; and on a remarkable Multiplication observed in the Parts of Fructification of that Genus.* By Mr. David Don, Libr. L.S.

Read November 18, 1828.

THE ligulate rays of *Zinnia* consist of a foliaceous, persistent, coloured, and highly vascular membrane, with rough, spinously-denticulated edges. They are traversed by two principal trunks of vessels almost parallel to their margin, which branch out into innumerable ramifications through the disk. These trunks, which are composed of proper and spiral vessels, may be very distinctly traced from the limb of the ray downwards along the two prominent edges of the ovarium. The vessels become more apparent on the withering of the rays, and the beautiful arrangement of their ramifications constitute then an interesting object. The principal trunks of vessels, thus occupying both sides of the lamina, tend to extend them so considerably beyond the centre, as to constitute frequently two distinct lobes. The want of articulation in the tube, visible in the florets of the disk, their consistence, and the disposition of the vessels, and their ramification,—a disposition which is found precisely the same in the central ovaria,—would seem to prove that the rays of *Zinnia* are an elongation of the exterior cortical layers of the ovarium, which in the centre florets are developed into a species of paleaceous pappus, which is not present in the ray florets. The peripheral ovaria are frequently triquetrous, and each of the
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edges is occupied by a fascicle of vessels : the two parallel ones, which are also generally the most prominent, develop themselves into the ligulate appendage ; and the third, which occupies the facial edge, terminates abruptly in the sinus. There are other vessels which occupy the space between the three principal trunks. These circumstances taken together, have induced me to regard the corolla as wanting in the rays of *Zinnia*.

My own observations tend fully to confirm the interesting hypothesis advanced by Mr. Brown respecting the compound nature of the pistillum in *Compositæ*. In *Zinnia verticillata* and *multiflora* the branches of the style, especially of such flowers as have an increased number, only partially cohere together, are readily separable, and may be traced from the apex of the stigmata to their connexion with the two filiform cords to which the embryo is attached, and which Mr. Brown* regards as a species of placenta. These cords, which are particularly distinct in *Zinnia*, are slightly thickened at their extremity, and bear a striking analogy to the slender bases of the filaments, which are generally found adherent to the tube of the corolla, as the former are to the sides of the ovarium. The embryo is attached to the inner edge of the extremities of these cords, one of which I have frequently found not adhering to the parietes of the ovarium, but passing down its centre quite free. In some cases the branches of the style are found wholly free, so that they resemble so many distinct styles ; and they may not unaptly be compared to those of *Umbelliferae* and *Araliaceæ*. The embryo of *Zinnia* is easily extracted from the ovarium entire suspended between the two placental cords, and surmounted by the style and stigmata ; and as there appears to be no interruption between the branches of the style and these cords, it occurred to me as probable that they would prove only a continuation of that organ.

* *Linn. Trans.* vol. xii. p. 89.

The parts of fructification of *Zinnia* vary exceedingly in number, and on this account there is not perhaps a more interesting genus in the whole class to which it belongs. While engaged examining a capitulum of *Zinnia verticillata* in the garden at Boyton in September last, my attention was arrested by a floret of unusual size occupying the centre of the disk; and on removing and placing it under a common lens, I discovered that the limb was divided into 10 lobes; that it had 10 stamina, and 10 stigmata, all perfect. On laying open the ovarium longitudinally, I found 5 embryos occupying the interior of its cavity, and connected together in a cluster: they were of unequal size, and their cotyledons were deformed and unequal, and in some instances solitary. I extended my researches to other capitula of the same species, and likewise to those of *Z. revoluta*, *multiflora*, and *pauciflora*, and found the deviations from the typical form of corolla frequent in all of them; and that the limb varied with 3, 4, 5, 6, 7, 8, and 10 lobes; that the stamina were 4, 5, 6, 7, 8, or 10; and the stigmata, 2, 3, 4, 5, 6, 8, or 10. In such florets as had their limb divided into 3 or 4 lobes only, the stamina were sometimes of the usual number, 5; but in the others, the stamina were always found corresponding in number with the divisions of the corolla. The stigmata were found to be indefinite, and generally not influenced by the number of the other parts of the flower: for in the usual form of corolla,—namely, with 5 lobes,—3 were as frequently observed as 2, and sometimes, although more rarely, 4, 5, and 6; and in the 6-cleft corolla they frequently did not exceed the ordinary number. In those flowers where the segments of the corolla amounted to 8 or 10, the stigmata sometimes equalled that number; but in the 10-cleft corolla the stigmata were often found not to exceed 5. With an increased number of stigmata there is always a plurality of embryos: for example,
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with 4 or 5 stigmata, the number was two or three ; with 6, three ; with 8, four ; and with 10, five ; but when they exceeded two, they were found generally to be imperfectly formed and united together, having but seldom more than one cotyledon ; and where no increase takes place, as very often happens, the embryo is always found to be distorted, and the cotyledons unequal. It is not unusual to find, even in a floret of the ordinary structure, but with an increased number of stigmata, a monstrous embryo having several unilateral, dolabriform cotyledons, and a long, filiform radicle. In the perfect embryo of *Zinnia* the cotyledons are linear-oblong, obtuse, with a straight, subulate radicle scarcely half their length.

In conclusion it may be observed, that deviations from the typical form are of rare occurrence in the flowers of *Zinnia elegans*, as in all the capitula of that species, which were examined by me, I did not meet with a solitary instance. The species in which I have found them most frequently to occur is *Zinnia verticillata* ; for almost every capitulum of this species will be found to furnish many examples : and the circumstance of the leaves being frequently verticillate in this species would appear to exert an influence over the parts of fructification, affording a striking proof, as it appears to me, of the correctness of the theory advanced by Mr. Brown respecting the origin of those parts, and also of his hypothesis regarding the plan on which the female organ in phænogamous plants* is formed. In *Zinnia verticillata* I have occasionally met with hermaphrodite florets, having 5 stamina and 5 perfect stigmata.

* Linn. Trans. loc. cit.